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HENRY O'MALLEY, Commissioner

GOLDFISH THEIR CARE IN SMALL AQUARIA

By E. C. FEARNOW

*Superintendent of Fish Distribution
U. S. Bureau of Fisheries*

APPENDIX XII TO THE REPORT OF THE U. S. COMMISSIONER
OF FISHERIES FOR 1922



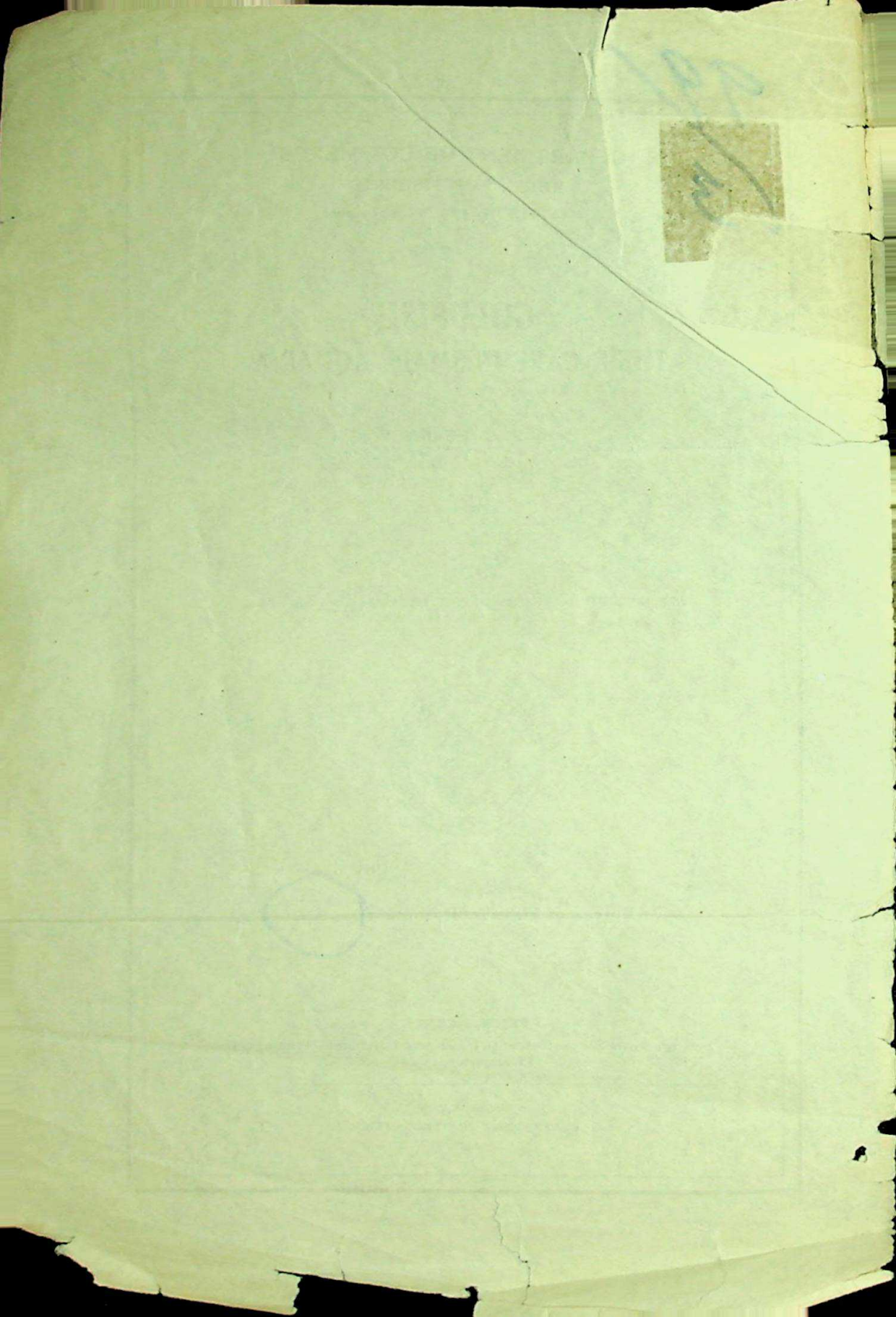
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GOLDFISH: THEIR CARE IN SMALL AQUARIA.¹

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Superintendent of Fish Distribution, U. S. Bureau of Fisheries.

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INTRODUCTION.

Although the Bureau of Fisheries neither propagates nor distributes ornamental fish, the need of a publication for use in answering the numerous inquiries concerning the care of goldfish has been apparent for some time. It is the aim of this article to set forth briefly such practical advice as appears necessary for the amateur aquarist.

Since the bureau is concerned in the propagation of the food and game fishes only it has no literature on the methods of goldfish breeding. Excellent advice on this subject may be obtained by consulting the current publications on goldfish. Neither does the bureau serve as a medium for advertising goldfish or aquarium accessories. Publications devoted to aquarium fishes and related subjects contain advertisements of dealers in goldfish, aquatic plants, and in fact everything that is needed by the aquarist.

In the preparation of this publication the following authorities have been freely consulted: Wolf, Mulertt, Innes, and Aquatic Life. (See Bibliography.)

SUITABLE FORM OF AQUARIUM.

Because of its narrow neck the so-called fish globe is not adapted to keeping goldfish in a comfortable and healthy state, its small amount of water surface not permitting the process of absorption of air on a scale sufficient for the well-being of the fish. Another objectionable feature of the globe lies in its reflection and refraction of light rays, which tends to make the fish nervous and uneasy.

An aquarium with straight sides is the only suitable form. It should be of rectangular shape and of equal width at the top and bottom. The rectangular battery jar, which may be purchased in the 5-gallon size, will give good results. The depth of water should be about the same as the width of the aquarium, and the bottom should be covered with clean sand and gravel to the depth of $1\frac{1}{2}$ inches. Ordinary sand and pebbles are best for this purpose, as the more desirable aquarial plants draw most of their nourishment from the water and require merely an anchorage. In order to insure an abundant air supply, plants of high oxygenating powers should be selected for the aquarium.

¹ Appendix XII to the Report of the U. S. Commissioner of Fisheries for 1922. B. F. Doc. 935.

SUITABLE AQUARIAL PLANTS.

Among the most suitable plants for an aquarium are anacharis and fanwort. Anacharis, *Anacharis canadensis gigantea* (Fig. 1), is a good oxygenator and at the same time provides forage for goldfish. Fanwort, *Cabomba caroliniana* (Fig. 2), is a very hardy species and

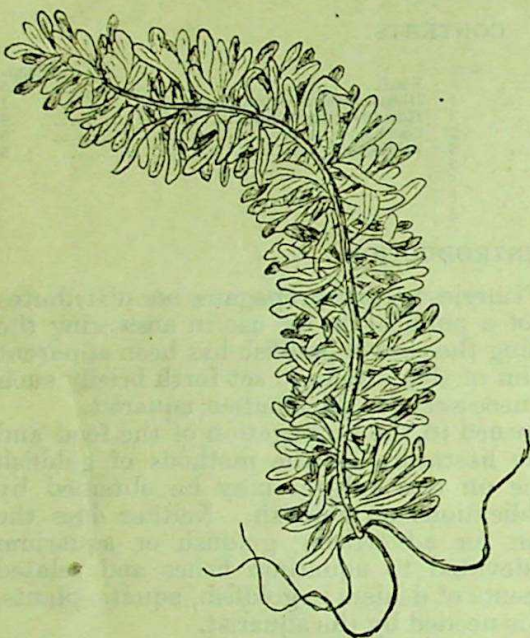


FIG. 1.—Anacharis (*Anacharis canadensis gigantea*). One-half natural size. A good oxygenator; grows rapidly; thrives with or without roots when set in pebbles or sand; may be purchased of dealers. This is considered the most satisfactory plant for the amateur aquarist.

thrives well in small aquaria. It is evergreen, will grow from cuttings, especially the forked joints, and a branch planted in the sand at the bottom of an aquarium will produce roots. These plants are very common, and supplies can usually be purchased from goldfish dealers. Other desirable aquarial plants are willow moss, *Fontinalis antipyretica* (Fig. 3), and arrowhead, *Sagittaria natans* (Fig. 4). Very beautiful aquatic gardens may be made by a proper selection of plants. A frequently used and very hardy and beautiful plant is the hornwort, *Ceratophyllum demersum* (Fig. 5), but it requires careful attention, as it is liable to decay and contaminate

the water. Moreover it is dormant in the winter and has only decorative value at that period. Ludwigia, *Ludwigia glandulosa* (Fig. 6), is highly prized for its fine appearance in the aquarium and is easily propagated from cuttings.

BALANCED AQUARIUM.

When the relations of plant life and animal life in an aquarium are properly proportioned the aquarium is said to be self-sustaining or balanced, and under such a condition the water requires no change. Filling in to make up for what has evaporated is all that is necessary; or, if preferred, about half the water may be drawn off through a siphon and a similar amount of fresh, aerated water added. During very warm weather this will probably have to be done about once a month. If the water should become vitiated at any time the aquarium must be thoroughly cleansed and the entire water supply renewed, the fish first having been removed to another vessel. When fish become restless and rise to the surface of the water to breathe, it indicates that the oxygen supply in the aquarium is insufficient. Relief may be given them by dipping up and pouring back some of the water.

A small aquarium can not sustain much life. Fishes, like human beings, can not thrive in crowded habitations, and thousands of goldfish have been lost by the overstocking of aquaria. The number that can be maintained in healthful condition in a 5-gallon vessel

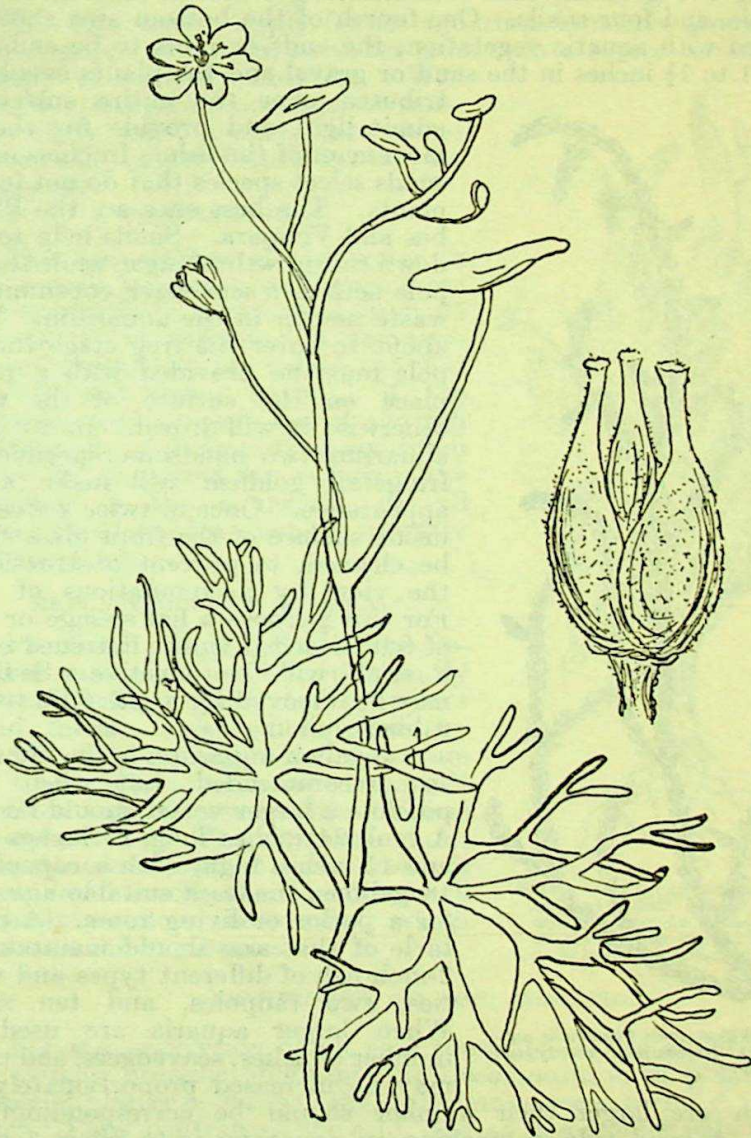


FIG. 2.—Fanwort (*Cabomba caroliniana*). Natural size. Found in ponds and slow streams, southern Illinois to North Carolina, south to Florida and Texas.

will depend upon its location and shape, the water temperature, character of the plant life, size of the fish, and the amount of light admitted.

It is better for beginners to start with a few of the hardier varieties of goldfish until the fundamental principles of aquarium keeping are

understood. When common goldfish can be kept with no losses it is time to branch out and undertake the keeping of the more interesting breeds.

A well-balanced aquarium of 5-gallon capacity is capable of maintaining two goldfish, each 2 inches long exclusive of tail, one frog tadpole, and four snails. One-fourth of the bottom area should be planted with aquatic vegetation, the ends or roots to be embedded from 1 to 1½ inches in the sand or gravel and the plants evenly distributed

over the entire surface, to admit light and provide for the free movement of the fish. In choosing the snails select species that do not feed on plants. The best ones are the Planorbis and Vivipara. Snails help to keep down the growth of algae, while the tadpole acts as a scavenger, consuming all waste matter in the aquarium. When about to enter the frog stage the tadpole must be provided with a resting place on the surface of the water, otherwise it will drown. In a 5-gallon aquarium two handsome specimens of fringetail goldfish will make a fine appearance. Once or twice a week the inside surface of the front glass should be cleaned, to prevent obstruction of the view by accumulations of algae. For this purpose a flat sponge or piece of felt attached to the flattened end of a stick will be effective. Sediment may be removed by a glass dip tube or rubber siphon.

A 5-gallon aquarium is the minimum size recommended, but when it is possible a larger vessel should be used. A tank 24 inches long, 12 inches wide, and 15 inches high, with a capacity of 18 gallons, makes a suitable aquarium for a parlor or living room. A receptacle of that size should maintain five 2-inch fish of different types and varieties, two tadpoles, and ten snails. When larger aquaria are used the number of fishes, scavengers, and plants may be increased proportionately. If

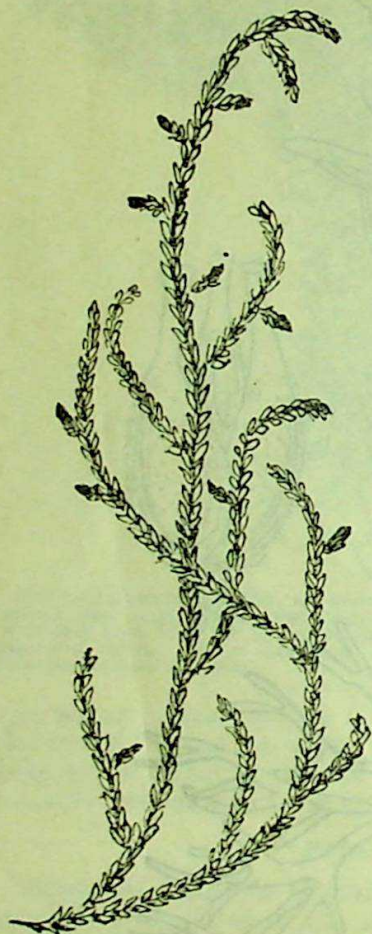


FIG. 3.—Willow moss (*Fontinalis antipyretica*). Natural size. A fairly good oxygenator.

the fish are larger their number should be correspondingly reduced. A good rule in stocking an aquarium is to allow 1 gallon of water to each one-half inch of fish.

LIGHT.

The aquarium should have a northern or northeastern exposure in summer, but in winter it is advisable to so locate it that it will get the sunlight two or three hours a day. The light should enter an

aquarium in about the same way it enters a stream, from the surface of the water. Too much light will overstimulate the growth of algæ, causing the water to turn green.

WATER.

The best water supply for an aquarium is nearly always from a river, pond, or cistern, as water from such a source conforms more nearly to natural conditions. Well water usually contains lime or salts, especially lime, making the water hard and entirely unsuited to the purpose.

TEMPERATURE.

The temperature of the water in an indoor aquarium will range from 50 to 80° F. in winter and from 65 to 80° F. in summer. A temperature somewhat in excess of 85° should not prove harmful if the water is well aerated, but if the fish show signs of distress their condition may be improved by reducing the number in the aquarium. In all cases avoid sudden changes in water temperature.

REPLACEMENT OF MINERALS.

Provision should be made to replace minerals that are constantly absorbed from the water by plants and fishes. This can be done by occasionally adding salts, a mixture of three parts of evaporated sea salt and one part of Epsom salts. A level teaspoonful to 20 gallons of water about once in two or three weeks is considered beneficial. The fishes will usually swallow these salts, which act as a mild cathartic.



FIG. 4.—Floating arrowhead (*Sagittaria natans*). One-half natural size. A very desirable plant for the aquarium. Flowers above water surface, but fruit ripens on or below the surface of the water.

PREVENTION OF ACID CONDITION.

For the prevention of an acid condition in the aquarium, which is usually brought about by the decomposition of plants, a small piece of plaster of Paris in the aquarium is recommended. The plaster of Paris neutralizes the acid, and as it dissolves only under acid conditions there is no danger of getting the water too alkaline. When the plaster of Paris dissolves quickly it is a sure sign of acid condition.

FOOD.

Most aquarium fishes desire a variety of foods, and the aquarist should endeavor to imitate nature. Whatever foods are used it should always be borne in mind that a balance of vegetable, animal,

and mineral content is required. The best prepared foods are those that are granular in form and usually of dark color. Such foods may be purchased at pet stores and contain a mixture of flour, fish roe, meat, etc. Dried bread crumbs are frequently recommended as food for goldfish, especially when whole wheat bread is used.

Goldfish in an aquarium should be fed every day in summer and every other day in winter. Substitutes for natural food are scalded and dried earthworms, dried liver, fish roe, ant eggs, rice flour, pea flour, etc. Many combinations may be used, the best ones being

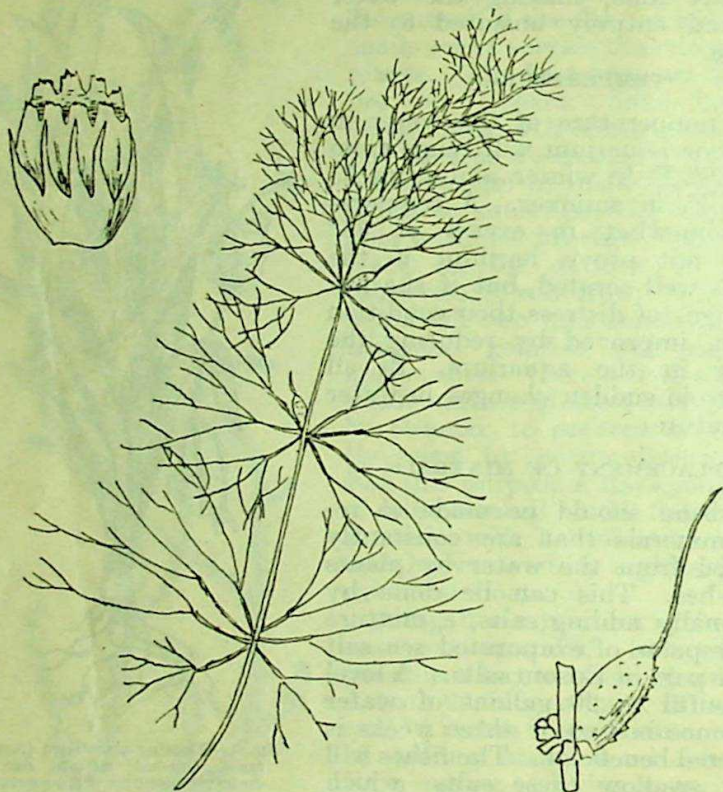


FIG. 5.—Hornwort (*Ceratophyllum demersum*). Natural size. Found in ponds and slow streams throughout North America, except extreme north. This plant is shallow-rooted, deriving most of its sustenance from the water.

those containing animal, crustacean, and starchy ingredients, together with some digestible form of lime, such as powdered egg shells, table salt, and Epsom salts.

A well known goldfish food consists of 5 ounces of pea flour, 4 ounces of rice flour, 2 ounces of dried and powdered fish flesh (herring), $\frac{1}{2}$ ounce of finely divided dried meat fiber (beef heart), 2 ounces of dried *Daphnia*, $1\frac{1}{2}$ ounces of ant eggs (pupæ), 1 ounce of dried powdered prawn (shrimp or lobster), 2 raw eggs together with the powdered shells, $\frac{1}{4}$ ounce of table salt, $\frac{1}{8}$ ounce of Epsom salts, and sufficient gum arabic in boiling water to bind the mass. This is thoroughly kneaded into a thick dough, dried at low temperature, and crushed into convenient particles, making about a pound of dried food. Just before

feeding the granules are steeped in lukewarm water, or they may be forced through a colander or other device to produce a vermicellilike form. It is the opinion of a good authority on goldfish that this food contains too much animal substance to produce entirely satisfactory results.

Prepared foods containing many of the ingredients mentioned are for sale in the market and their use can be recommended to the amateur aquarist. The main thing to guard against is the giving of more than the fish will consume at one feeding, as any excess allowed to remain in the water will eventually pollute it and produce diseased conditions.

Daphnia, popularly known as "ditch fleas," are an excellent live food for goldfish. The same may be said with reference to the larvæ of the mosquito, which can be had in large quantities during the summer months and may be found in rain barrels or stagnant pools, the common name being "wrigglers."

DISEASES AND THEIR TREATMENT.

Illness among goldfish becomes apparent in many ways, but as a usual thing the fins are blood-shot, the dorsal fin droops, and the affected fish is inclined to rest on the floor of the aquarium, with little or no desire for food. Where only one fish is diseased the cause may be attributed to overfeeding or constipation, but if a number are ill it is an indication that something is radically wrong, either with the food, the water, the oxygen supply, or the temperature conditions.

The excrement in health is dark, either a brownish green or black. If white or yellow it indicates overfeeding. When a fish becomes diseased, it should be immediately removed from the aquarium.

Goldfish must be handled gently and as little as possible, to avoid injury to their scales, fins, or tails. The dip net used for their transfer to and from the aquarium should be round and somewhat deep, rather than funnel-shaped. If it can be avoided, fish should never be grasped by the hands.

Sudden changes in temperature produce the diseases known as "white fungus" and "tail rot." When a whitish coating or splitting of the fins is noted the affected fish should be placed in another

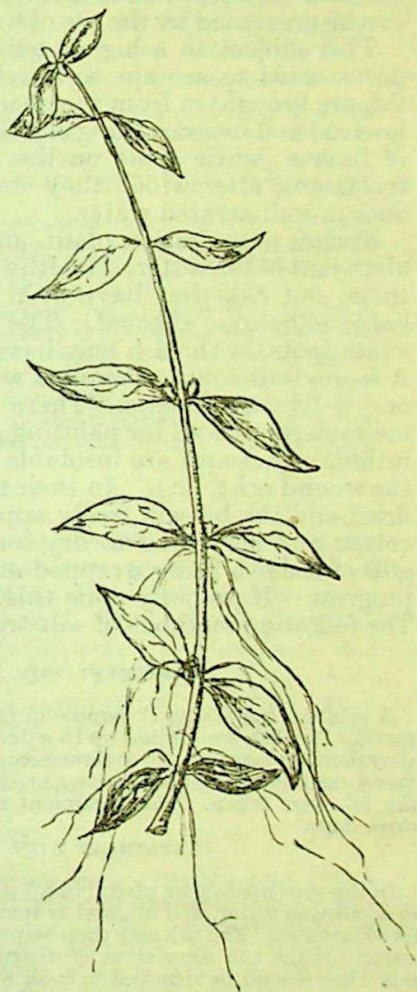


FIG. 6.—Ludwigia (*Ludwigia glandulosa*). Natural size. Prized for its beauty in the aquarium; grows from cuttings.

jar containing water just salty enough to be noticeable to the taste and kept there until cured, the salt water being changed daily. This treatment is good for run-down fish as well as for those that are diseased.

To overcome constipation, dissolve a tablespoonful of Epsom salts in a gallon of water and allow the fish to remain in the solution for a few hours if necessary. Then let them rest a day or two in a mild solution of Epsom salts with a little sea salt added. Constipation can be prevented by the use of live foods, such as *Daphnia*, at intervals.

Fish subject to a higher temperature than that which they were accustomed to are apt to develop fungus or other diseases. When fish are brought in from the open the temperature should be gradually lowered and overcrowding should be avoided. At the first indication of fungus (white spots on the fins) the fish should be given a salt treatment, after which they should be kept apart from the healthy ones in well-aerated water.

Fungus is a parasitic plant, and species of it are always more or less abundant in the water. Healthy fish usually have the strength to resist them, but fish that have been injured by injudicious handling are liable to become affected. The fungus will be observed as black and white spots, or the fish may have most of its body covered with slime. A strong salt solution applied with a cotton swab will effect a cure in one or two treatments. There are preparations on the market that are sometimes used for painting spots made by fungus. These preparations or balsams are insoluble in water and act as a covering while the wound is healing. In their use the affected parts are cleaned and dried and the balsam freely applied with a small brush or a piece of cotton and permitted to dry for about three minutes, the head and gills of the fish being wrapped in a wet cloth while the operation is in progress. If properly done this will not endanger the life of the fish. The following methods of salt treatment are in common use:

TREATMENT WITH STRONG SALT SOLUTION.

A solution containing 13 ounces of common table salt per gallon of water is prepared. The fish are dipped up in a deep net and lowered in the salt solution where they should remain for two or three seconds. The fish are then transferred to another vessel containing well-aerated water of the same temperature as that from which the fish were taken. This treatment may be profitably repeated daily for two or three days.

TREATMENT WITH DILUTE SALT SOLUTION.

In this case the fish are placed in a 3 per cent solution of common table salt, $\frac{1}{4}$ pound to a gallon of water, and allowed to remain in the bath with aeration of the solution for 30 minutes. The fish may then be placed in another vessel containing well aerated water. If the fish show signs of distress during the half hour, by turning on one side, they should be removed to fresh water. The treatment may be repeated daily on the following two or three days.

On cloudy days even in well-conditioned aquaria fishes will come to the surface of the water to breathe, but if they do this in clear weather it is a sign that something is wrong. The trouble may be from one of the following causes: Too few plants, too high temperature, or decomposition of unconsumed food. The cause should be found and removed as quickly as possible.

Goldfish are subject to many diseases not described in this publication, among them being inflammation of the eyes, an affection of the swimming bladder, dropsy, and consumption. The last two

are usually fatal. It is not possible to enter into details concerning these diseases and their treatment. Further information on the subject may be obtained from the standard books on goldfish culture, a selective list of which is herewith appended. Many of these books may be consulted at the public libraries.

HOW TO DISTINGUISH SEX.

In goldfish as well as in other fishes the male and female are so similar in external appearance that the sex can be determined only by an examination of the internal sexual organs. The following extract from *Aquatic Life* will be of interest to amateur aquarists:

Quite the first question to be asked by one desiring to breed goldfish is how the sexes may be distinguished. It has been shown that a slight difference in contour exists in the region about the anus, but it is exceedingly hard to discern, and not a few experienced fanciers will refuse to guarantee the sex of a fish based on this feature alone.

When in condition to breed the distinguishing points are very evident. The male develops tubercles or "salt spots" on the gill-plates and along the first ray of the pectoral fins. These marks may be absent from the fins, and but few in number on the gill-plates. The tubercles are usually considered an infallible distinction, but are not absolutely so. Once in a lifetime a fancier may find a female with tubercles.

The female, except about the anus, exhibits no sexual difference until the development of the roes causes a distention of the body, which is more evident from a top view than from the side. Other than this, it possesses no characters to distinguish it from the male. If both sexes are in the same tank, precocious males may "drive" barren females, and in that manner aid in identification, but a doubt may be cast on the certainty of it by the fact that males will sometimes drive other males.

CONCLUSION.

Cleanliness, good light, plants well distributed over the bottom, proper food in moderate quantity, scavengers, prompt removal of sick fish, and avoidance of overstocking are the essential factors for the maintenance of a successful aquarium. Thousands of goldfish have been killed by lack of observance of a few simple rules and many are lost through mistaken kindness. The globe in the sunlight is a veritable torture cell. Avoid tapping on the glass, as it frightens the fish. The fact that goldfish can endure a great deal in the way of unwholesome environment is not an excuse for torturing them. Moreover, with proper care they will thrive and attain a great age.

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